ENVIRON

March 9, 2012

Ms. Sharon Fang, P.E.
Remedial Project Manager (3HS21)
U.S. EPA Region III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Re: Metal Bank Cottman Avenue NPL Site
Monthly Report due March 10, 2012
Reporting Period: February 1 through February 29, 2012

Dear Ms. Fang:

As provided in Paragraph 31 of the Utility Consent Decree, and on behalf of the Cottman Avenue PRP Group, Environ Corporation as the Supervising Contractor is submitting to USEPA three copies of a written monthly progress report. Copies of the monthly progress reports are attached to this letter.

Please contact the Designated Project Coordinator, Dr. John Dobi (973.430.8036) or me (617.946.6115) if you need additional information regarding this submission.

Very truly yours,

Environ International Corporation

Joseph P. Vitale

Joseph P. Vitale, PE
Project Director

cc: Cottman Avenue PRP Group
Steering and Technical Committees
Dan J. Jordanger, Esquire

Enclosures
3328374

Project Name: Metal Bank NPL Site	For the Month: February 2012	
Project Location: Philadelphia, PA	Report Number: 71	Dated: March 10, 2012

Name: Joseph P. Vitale (ENVIRON)	Title: Project Director
Telephone No.: (617) 946-6115	Telefax No.: (617) 946-3229

Reporting Period: February 1 through February 29, 2012

(a) Describe the actions, including submittal of work plans and other deliverables, which have been taken toward achieving compliance with the Consent Decree during the previous month:

Actions or Deliverables	Dates Performed or Submitted
Requested an extension to respond to EPA letter dated January 24, 2012 regarding the Fish and Worm Studies	Sent email to Sharon Fang on February 7, 2012
Sent Buoy Installation application to USCG	Letter sent to Mr. Flynn of USCG on February 12, 2012 via email and regular mail. EPA cc;d on that email
Requested an extension to respond to EPA letter dated February 9, 2012 regarding upland and bathymetric surveys	Sent email to Sharon Fang on February 23, 2012
Sent our response to EPA letter dated January 24, 2012	Sent letter via email to Sharon Fang on February 26, 2012
Sent 2011Annual Long-term Monitoring Report to EPA	Sent via email and regular mail to Sharon Fang of EPA on February 28, 2012

(b) List summaries of inspections, sampling, testing, and other data received or generated in the previous month, and when possible, attach the documentation to this report:

Submittals	Dates Performed	Attached/Separate Cover
Sent Buoy Installation application to USCG	February 12, 2012	Attached email and letter
Sent our response to EPA letter dated January 24, 2012	February 26, 2012	Attached email and letter
2011 Annual Long-term Monitoring Report including Appendices	February 29, 2012	Previously sent to EPA under separate cover. Too large to submit with the Monthly Report

(c) Describe all actions, including, but not limited to, data collection and implementation of work plans, which are scheduled for the next month and provide other information relating to the progress of work:

The current 2-month look-ahead schedule for LTM and O&M is as follows:

LTM Activities	Start Date	Anticipated Completion Date
Installation of warning buoys *Approval from USCG pending	4/1/2012*	4/2/2012
Semi-annual Groundwater Sampling Event	4/24/2012	4/25/2012
Upland and Sheet Pile Wall Monitoring Inspections	4/24/2012	4/25/2012

(d) Include information that may affect the future schedule for implementation of the Work, and a description of efforts made to mitigate those delays or anticipated delays:

- We are waiting on a decision from EPA regarding our February 26, 2012 request to:
  - modify the bioaccumulation monitoring plan substituting *corbicula* for *lumbriculus*.
  - withdraw their recommendation to conduct a second round of fish sampling.

(e) Include any modifications to the work plans or other schedules that the Utility PRP Group has proposed to EPA or that have been approved by EPA:

- None

(f) Describe all activities undertaken in support of the Community Relations Plan during the previous month and those to be undertaken in the next month:

- The Group will coordinate with EPA on any community outreach endeavors on an as needed basis through the Long Term Monitoring period.

From:	Joseph Vitale
To:	Thomas.W.Flynn@USCG.MIL
Cc:	Sharon Fang; Margaret Pollich (mpollich@pa.gov); John Dobi (john.dobi@pseg.com); Johnson, Sterling H NAP; William Rottner
Bcc:	Dan Jordanger (djordanger@hunton.com)
Subject:	Metal Bank NPL Site - Buoy Installation Request
Date:	Sunday, February 12, 2012 3:45:00 PM
Attachments:	Buoy Application USCG.pdf

Dear Mr. Thomas W. Flynn:

Attached to this email is our request to install three warning buoys in the Delaware River adjacent to the Metal Bank NPL site located in Philadelphia, Pennsylvania. We are installing these buoys at the request of U.S. EPA Region III. A hard copy of this request is being sent regular mail.

We appreciate your assistance in this matter. If you have any questions, please give me a call.

Joseph P Vitale, PE, LSP | Principal Consultant
ENVIRON | www.environcorp.com
20 Custom House Street, 8th Floor, Boston, MA 02110
V: 617-946-6115 | M: 617.721.2766 | F: 617.946.3229 **jvitale@environcorp.com**

DEPARTMENT OF HOMELAND SECURITY
U.S. COAST GUARD
CG-2554 (Rev. 03-03)

PRIVATE AIDS TO NAVIGATION APPLICATION

(See attached instructions and copy of Code of Fed. Reg., Title 33, Chap. 1, Part 66)

Form Approved
OMB-1625-0011

NO PRIVATE AID TO NAVIGATION MAY BE AUTHORIZED UNLESS A COMPLETED APPLICATION FORM HAS BEEN RECEIVED (14 U.S.C. 83; 33 C.F.R. 66.01-5)

1. ACTION REQUESTED FOR PRIVATE AIDS TO NAVIGATION: A. [X] ESTABLISH AND MAINTAIN B. [ ] DISCONTINUE C. [ ] CHANGE D. [ ] TRANSFER OWNERSHIP

2. DATE ACTION TO START: March 15, 2012

3. AIDS WILL BE OPERATED: A. [X] THROUGHOUT THE YEAR B. [ ] TEMPORARILY UNTIL _____ C. [ ] ANNUALLY _____ TO _____

4. NECESSITY FOR AID *(Continue in Block 8)*: Warning/Danger buoys

5. GENERAL LOCALITY: N. Philadelphia

6. CORPS OF ENGINEERS AUTHORIZED THIS STRUCTURE OR BUOY BY [ ] PERMIT OR [X] LETTER *(file and date)*

FOR DISTRICT COMMANDERS ONLY

7. APPLICANT WILL FILL IN APPLICABLE REMAINING COLUMNS

LIGHT LIST NUMBER OR PAGE	NAME OF AID	NO. OR LTR. (7a)	LIGHT PER. (7b)	LIGHT FLASH LGTH. (7c)	LIGHT COLOR (7d)	POSITION (7e)	DEPTH OF WATER (7f)	CANDLE POWER (7g)	HT. ABOVE WATER (7h)	STRUCTURE TYPE, COLOR, AND HEIGHT ABOVE GROUND (7i)	REMARKS *(See Instructions)* (7j)
		A	5.5s	0.5s	White	E 2730571.11 N 261871.56	16 ft.	6.8	4 ft.	Can/white w/Red Markings	Lens diameter 4.25" LEDs/ 28" diameter can buoy
		B	5.5s	0.5s	white	E 2731226.35 N 261944.57	18 ft.	6.8	4 ft.	Can/white w/red markings	Lens diameter 4.25" LEDS/ 28" diameter can buoy
		C	5.5s	0.5s	white	E 2731788.35 N 262258.10	7 ft	6.8	4 ft.	Can/white w/red markings	Lens diameter 4.25" LEDs/ 28" diameter can buoy

8. ADDITIONAL COMMENTS
Notify boaters and other potential recreational users of the Delaware River of the potential subsurface obstacles created by the installation of three sub-aqueous caps installed as shown in the attached drawing

9a. NAME AND ADDRESS OF PERSON IN DIRECT CHARGE OF AID
Joseph Vitale
ENVIRON Corporation
20 Custom House St. Suite 800, Boston, MA 02110

9b. TELEPHONE NO.
617-946-6115

10a. NAME AND ADDRESS OF PERSON OR CORPORATION AT WHOSE EXPENSE
Cottman Ave PRP Group
c/o Hunton and Williams LLP
951 East Byrd St. Riverfront Plaza E. Tower
Richmond, VA 23219
ATTN: Dan Jordanger, Esq.

10b. THE APPLICANT AGREES TO SAVE THE COAST GUARD HARMLESS WITH RESPECT TO ANY CLAIM OR CLAIMS THAT MAY RESULT ARISING FROM THE ALLEGED NEGLIGENCE OF THE MAINTENANCE OR OPERATION OF THE APPROVED AID(S).
Yes

10c. DATE: 2/12/2012

10d. SIGNATURE AND TITLE OF OFFICIAL SIGNING
Joseph P. Vitale Project Director

FOR USE BY DISTRICT COMMANDER

SERIAL NO.	CLASSIFICATION OF AIDS				DATE APPROVED	SIGNATURE *(By direction)*
		RECD.				
		CHART				
		L. N. M.				

PREVIOUS EDITIONS ARE OBSOLETE

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA. PENNSYLVANIA 19107-3390

REPLY TO
ATTENTION OF

JAN 27 2012

Regulatory Branch
Application Section II

SUBJECT: CENAP-OP-R 2012-0039-76
Project Name: Metal Bank NPL Site

Mr. Joseph Vitale, PE, L.S.P.
ENVIRON Corporation
20 Custom House Street, 8th Floor
Boston, MA 02110

Dear Mr. Joseph Vitale:

This is in regard to your proposal to install three buoys in order to warn boaters in the Delaware River to avoid subaqueous cap (a.k.a. "marine mattresses") areas that were previously installed as part of an EPA-approved remedy at the Metal Bank NPL site located adjacent to the Delaware River in City of Philadelphia, Philadelphia County, Pennsylvania.

Under current Federal regulations, a Department of the Army permit is required for work or structures in navigable waters of the United States and/or the discharge of dredged or fill material into waters of the United States including adjacent wetlands.

Based on the information you have provided, it has been determined that the proposed project described in your submission does not require the approval of this office since activities undertaken entirely on a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site by the authority of CERCLA as approved or required by the EPA, are not required to obtain permits under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act. This letter does not affect your responsibility to obtain any other Federal, State, or local approvals required by law for the proposed work.

If you should have any questions regarding this matter, please contact Peter Romano at 215-656-6729 or write to the above address.

Sincerely,

Frank J. Cianfrani
Chief, Regulatory Branch

Copies Furnished:

Sharon Fang, EPA/Region III
Thomas Flynn, USCG
Sterling Johnson, CENAP-DP-IS

LEGEND

- CHAINLINK FENCE
- LEGAL RIGHT OF WAY
- PROPERTY LINE
- EDGE OF PAVEMENT
- EDGE OF STONE
- EDGE OF WATER
- JUNCTION BOX
- UTILITY POLE
- BENCH MARK
- MONITORING WELL
- RIP-RAP
- OUTLINE CONCRETE LNAPL SUMPS
- (100.569') PHILADELPHIA DISTRICT STANDARD MEASURE
- 100.569' U.S. STANDARD MEASURE

REFERENCE PLANS

1. PLANS ENTITLED "UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 3, REVISED REMEDIAL DESIGN, METAL BANK SITE, PHILADELPHIA, PENNSYLVANIA" SHEETS 1 THRU 49, PREPARED BY: AMEC EARTH & ENVIRONMENTAL, INC., PLYMOUTH MEETING, PA, DATED: 11/09/2007 & 4/04/2008.
2. PLAN ENTITLED "HYDROGRAPHIC SURVEY, METAL BANK NPL SITE, PRE-EXCAVATION SURVEY, SITUATED IN CITY OF PHILADELPHIA, PHILADELPHIA COUNTY, PENNSYLVANIA", PREPARED BY: LGA ENGINEERING, INC., LAKEWOOD, NJ, DATED: 9/08/2008.
3. PLAN ENTITLED "PLAN TO REVISE THE LINES AND GRADES ON PORTIONS OF CITY PLANS NO.S 55, 57, 187, 195, 196, 197, 258, 270, 278, 282, 291, 305 AND 306, PREPARED BY URBAN ENGINEERS, INC. CONSULTANTS. DATED JUNE 17, 1968.
4. PHILADELPHIA COUNTY TAX MAP 136 N 10.

GENERAL NOTES

1) PROJECT COORDINATE SYSTEM
HORIZONTAL: PENNSYLVANIA STATE PLANE COORDINATE SYSTEM (SPCS) NORTH AMERICAN DATUM 1983 (NAD 83).
VERTICAL: NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).

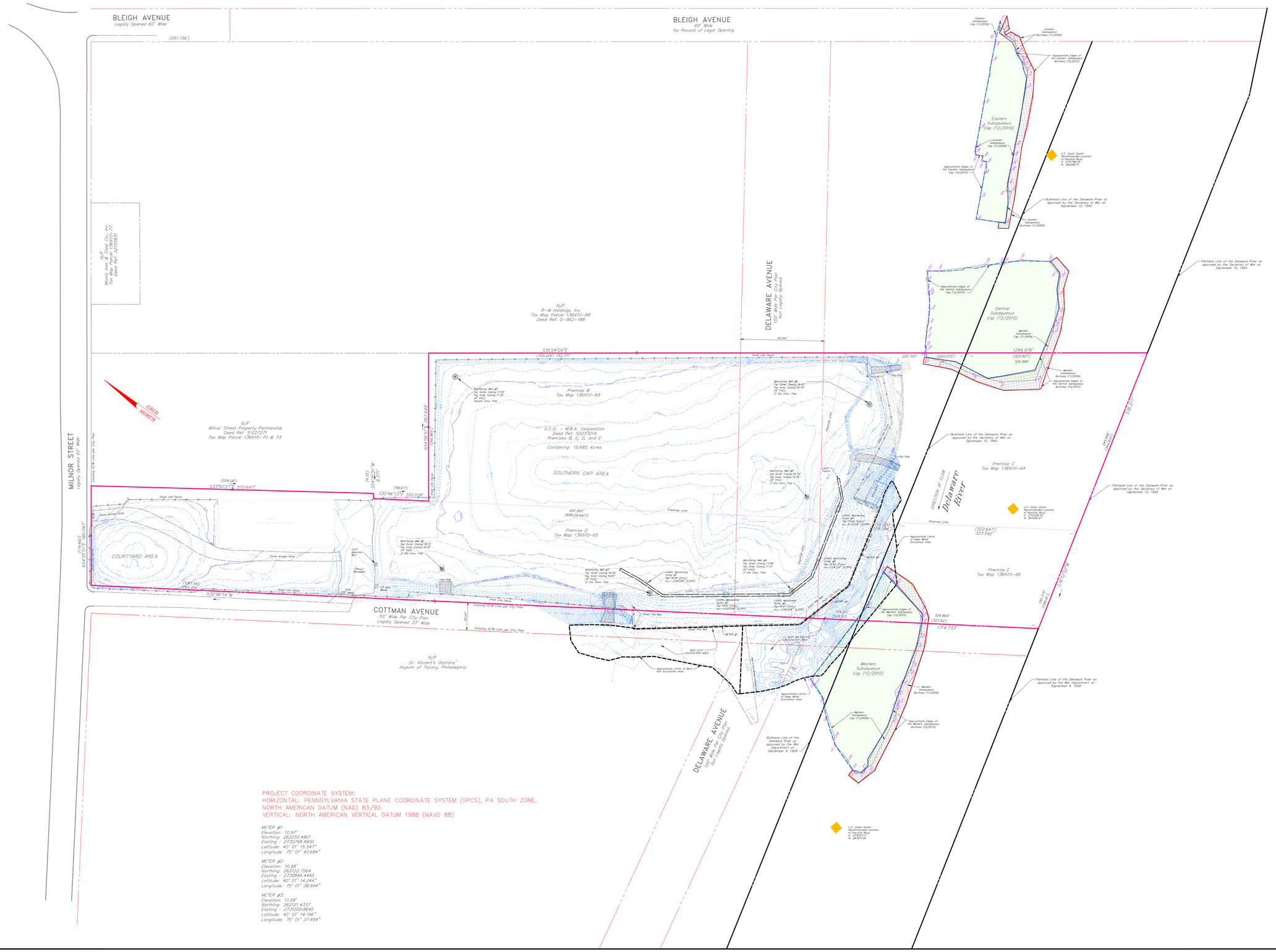
2) RETTEW ASSOCIATES TIED INTO EXISTING CONTROL AS SHOWN ON REVISED REMEDIAL DESIGN METAL BANK NPL SITE PREPARED BY AMEC EARTH AND ENVIRONMENTAL, INC. LAST DATED 11/7/07 AND PERFORMED A TOPOGRAPHIC SURVEY OF EXISTING CONDITIONS ON JULY 30, 2009.

3) DEED DIMENSIONS ARE BASED UPON PHILADELPHIA DISTRICT STANDARD SHOWN THUS (XXX.XXX').

4) U.S. STANDARD MEASURMENTS SHOWN THUS XXX.XXX', SCALE FACTOR OF 1.002939' PER DISTRICT STANDARD (MULTIPLY DISTRICT STANDARD DISTANCE (XXX.XXX') BY 1.002939 TO GET U.S. STANDARD MEASURE).

5) BEARINGS SHOWN ARE BASED UPON PENNSYLVANIA STATE PLAN COORDINATE SYSTEM (SPCS), PA SOUTH ZONE, NAD 83.

6) LOCATION OF THE UPSTREAM SUBAQUEOUS CAP AND BUTTRESS WERE FIELD LOCATED WITH GPS AND SHOULD BE CONSIDERED +/- 0.5 FOOT.



PROJECT COORDINATE SYSTEM:
HORIZONTAL: PENNSYLVANIA STATE PLANE COORDINATE SYSTEM (SPCS), PA SOUTH ZONE, NORTH AMERICAN DATUM (NAD) 83/92.
VERTICAL: NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88)

METER #1:
Elevation: 10.97'
Northing: 262250.4801
Easting : 2730748.9900
Latitude: 40° 01' 15.547"
Longitude: 75° 01' 40.684"

METER #2:
Elevation: 10.98'
Northing: 262122.7564
Easting : 2730884.4440
Latitude: 40° 01' 14.344"
Longitude: 75° 01' 38.994"

METER #3:
Elevation: 11.08'
Northing: 262121.4337
Easting : 2731000.8640
Latitude: 40° 01' 14.196"
Longitude: 75° 01' 37.499"

NO.	DATE	REVISION

FOR RETTEW ASSOCIATES BY:

MANAGER: RONALD L. HORST			
DESIGN BY:	CHKD BY:	FIELDBOOK NO. DATA COLLECTOR	
SURV. CHIEF:		DRAWN BY: RTHELLER	CHKD BY: RLH
		DRAWING REFERENCE:	

CLIENT
Malcom Pirnie Inc.
104 Corporate Drive
Mahwah, NJ 07430
Phone: 914-641-2801

SCALE 1" = 60' (1:720)

RETTEW
RETTEW Associates, Inc.
3020 Columbia Ave., Lancaster, PA 17603
Phone: (717) 291-1441 Fax: (717) 291-1063
Email: rettew@rettew.com
Website: www.rettew.com
Engineers • Planners • Surveyors • Landscape Architects
Certificate of Authorization

AS-BUILT SURVEY
FOR
METAL BANK NPL SITE
PHILADELPHIA PENNSYLVANIA

DATE: 03/02/2011
SHEET NO. 1 OF 1
DWG. NO. 10-02840-001

From: Joseph Vitale
To: Sharon Fang
Cc: john.dobi@pseg.com; Andrea Fogg
Subject: Metal Bank
Date: Thursday, February 23, 2012 4:23:00 PM

Hi Sharon:

As discussed yesterday, the Group will require 14 additional days to respond to EPA's letter dated February 9, 2012 regarding upland and bathymetric surveys. Thanks for agreeing to extend the period to respond to the February 9th letter.

Also, I spoke to Andrea Fogg, our certified ecologist who will be conducting the vegetative cover inspection, and she suggested that inspection should take place in late spring (June) consistent with the most recent version of the Vegetative Cover Plan. Ms. Fogg indicated to me that the vegetation would be much more lush than earlier in the season. The date we would like to conduct the vegetative cover inspection is Wednesday, June 6, 2012. Should EPA prefer an earlier date, we are available on May 23, 2012; however, we would prefer the later date based on the reasons discussed earlier.

Questions, please give me a call. Talk to you soon

Regards,

Joseph P Vitale, PE, LSP | Principal Consultant
ENVIRON | www.environcorp.com
20 Custom House Street, 8th Floor, Boston, MA 02110
V: 617-946-6115 | M: 617.721.2766 | F: 617.946.3229 **jvitale@environcorp.com**

From:	Joseph Vitale
To:	Sharon Fang
Cc:	john.dobi@pseg.com; David.Langseder@pepcoholdings.com; Craig S. Shamory (csshamory@pplweb.com); (George.Horvat@exeloncorp.com)
Bcc:	Dan Jordanger (djordanger@hunton.com)
Subject:	Metal Bank
Date:	Sunday, February 26, 2012 10:49:00 PM
Attachments:	Response letter to EPA letter dated Jan 24 2012.pdf

Hi Sharon:

Attached is our response to EPA's letter dated January 24, 2012. If you have any questions regarding this letter, please give me a call.

Joseph P Vitale, PE, LSP | Principal Consultant
ENVIRON | www.environcorp.com
20 Custom House Street, 8th Floor, Boston, MA 02110
V: 617-946-6115 | M: 617.721.2766 | F: 617.946.3229 **jvitale@environcorp.com**

ENVIRON

February 24 2012

Ms. Sharon Fang
Remedial Project Manager (3HS21)
U.S. EPA Region III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Re: Metal Bank Cottman Avenue NPL Site
Response to EPA's Letter Dated January 24, 2012

Dear Mrs. Fang:

We have reviewed your letter of 24 January 2012 regarding the fish monitoring and benthic bioaccumulation programs and have prepared the following responses. The Cottman Avenue PRP Group and USEPA share a desire to move forward on this site in a manner that is protective of human health and the environment and we remain committed to our shared goals. However, we respectfully disagree with many of USEPA's conclusions and recommendations. In this letter we document our rationale and supporting analyses on topics we agree upon and those where we disagree. We recognize that the fish monitoring program has yielded conflicting results but, as we document below, there is sufficient data to reach a defensible and sufficiently conservative determination. We concur with USEPA that reliable biomonitoring data is required to evaluate the effectiveness of the remedial action and to ensure the protectiveness of the remedy and share USEPA's goal of obtaining the necessary data while disagreeing on the best way to proceed. The failure to collect usable bioaccumulation data during the 2011 *Lumbriculus* study clearly indicates that an alternative approach is required.

Fish Monitoring

In accordance with our agreement with USEPA made on October 25, 2010 and described in the Long Term Monitoring Work Plan (LTM) (Arcadis 2011), fish tissue samples were collected in 2011 and analyzed for PCBs according to the procedures in the Standard Operating Procedure (SOP – 06) which were reviewed and approved by USEPA. The results were to be compared to the site specific threshold level of 1 ppm wet weight, an exceedance of which is a potential trigger for congener based tissue analysis. No other threshold values are specified in our agreement.

Fish were collected from 31 May to 2 June 2011. Fish were collected from five locations in the Delaware River, which included three near shore locations consisting of one sample location within the tidal mudflat area and two sample locations near the sheet pile wall facing the river. The remaining two sample locations were an upstream location (upstream of Pennypack Creek) and a downstream location (downstream of the Tacony Palmyra Bridge). Fish were collected using electro-fishing, seining, and baited minnow traps. Only forage fish, which exhibit high site fidelity, were collected and included banded killifish (*Fundulus diaphanus*), mummichog (*Fundulus heteroclitus*), Eastern Silvery minnow (*Hybognathus regius*) and spotfin shiner (*Cyprinella spiloptera*). The Group also made available to USEPA eels *(Anguilla rostrata*) that were caught during the study.

14000 SE Johnson Road, Suite 200, Milwaukie, OR 97267 www.environcorp.com
Tel: +1 503.353.1734 Fax: +1 503.353.1653

The fish were composited by location and species. Additionally, two field duplicate samples were obtained to address variability in the sampling and analytical processes. The samples were shipped to the Group's laboratory (TestAmerica Knoxville) and homogenized. The homogenate was split into two aliquots, with one aliquot shipped to USEPA's designated laboratory for analysis. The samples were analyzed for total PCBs using method 8082 and the results were to be reported on a wet weight basis. All laboratory QA/QC was performed by TestAmerica and passed as specified in the LTM. Following analysis, the TestAmerica data were validated in accordance with the QAPP Addendum. USEPA analyzed the split samples for total PCBs using method 8082 and PCB congeners using method 1668. EPA additionally analyzed six eel samples (four onsite and two from the reference areas) for PCBs using method 1668. USEPA's results were made available to the Group in two stages. USEPA's congener results for the eels were made available to the Group on December 7, 2011, and USEPA's congener results for the forage fish split samples were made available to the Group on January 31, 2012.

ENVIRON has performed the following analysis of the fish tissue data. The results of the Group's analyses, and the split analyses conducted by USEPA, were compared to the threshold value of 1 ppm wet weight. Many of USEPA's results were reported on a dry weight basis, which is not applicable to the threshold values. All dry weight results were converted to a wet weight basis using the percent solids values reported by the respective laboratories. The results of the Group's analysis and USEPA's 8082 analyses of the forage fish are shown in Table 1 (attached). Note that there was significant variability between the Group's result and those reported by USEPA. Specifically, the Group reported no exceedances of the 1 ppm value while USEPA reported multiple exceedances. These differences were investigated by a data validator at Environmental Standards. The differences were attributed to two factors, the first of which was the possibility of matrix interference and the second was a failure to report the results on a wet weight basis. At the request of the data validator, the USEPA results for Aroclor 1254 were re-quantified using two peaks in an attempt to minimize any biases associated with matrix interference. This differs from the three peak method used in the original quantification. It is important to note that the results of the USEPA 1668 analysis were not presented to the Group's validator and therefore were not considered in the evaluation. USEPA and the data validator did not reach agreement as to which quantification was more valid so both are presented here. USEPA also had the samples analyzed for PCB using method 1668, a high resolution GCMS method that allows for the quantification of individual congeners. Total PCBs reported based on the Group's analyses, the two quantification methods from the EPA 8082 analysis, and the EPA 1668 analyses were converted to a wet weight basis and are presented in the attached Table 1. The table also includes the WHO 2005 TEQ values for the PCB congeners calculated by USEPA.

As shown in Table 1, there are four different sets of total PCB values that can be used to evaluate the fish tissue concentrations. There are some important contrasts in the PCB results that merit further investigation. As documented previously, we have converted all of the PCB results to a wet weight basis to allow a valid comparison to the threshold value of 1 ppm. Aside from the USEPA analysis based on three peaks for 1254, which is likely to be biased high due to matrix interference, all of the total PCB values are well below the threshold value of 1 ppm (1 mg/kg). In fact, the results from the Group's lab are quite consistent with the results reported

from USEPA using the congener method (1668). When cleanup and analytical procedures are followed, method 1668 is generally considered to be highly resistant to matrix interference. This finding supports the likelihood that the EPA 8082 results based on three 1254 peaks were biased high due to matrix interference and should be superseded by the Group's results and the 1668 results. Although the results are not consistent between all the various analytical methodologies, the preponderance of the evidence indicates that the PCB concentrations in the fish tissue samples are well below 1 ppm, the value that triggers additional analysis and consideration of the fish tissue. In fact, the USEPA 8082 results based on three peaks is the sole line of evidence suggesting an exceedance of the threshold value – and it is also weakest line of evidence for the reasons described above. A detailed comparison of the entirety of fish tissue results indicates no exceedance of the 1 ppm value. Consequently, additional fish monitoring is not indicated for 2012.

In the letter dated January 24 2012, USEPA has compared the PCB TEQ whole body fish tissue results to an additional screening value that has not previously been applied to this site: a 1.35 ppt human health based screening value for 2,3,7,8-TCDD. That value was derived by USEPA to represent an acceptable non cancer threshold assuming 54 g/day of fish consumption on a wet weight basis. This screening value assumes all fish are consumed at the identified concentration and that consumption from this resource occurs for 30 years (USEPA 2012). This assumed consumption rate is equivalent to about 1.6 eight ounce meals per week. That consumption rate is likely a substantial overestimate of the amount of fish that would or even could be harvested from the affected area. Application of the screening value to whole body fish also is not representative of human consumption. Whole body fish typically have a higher PCB concentration than fillets due to the higher lipid content in the whole body, which has been reported to be about 3-fold that in fillets (Johnson et al. 2007). In deriving a risk-based concentration for PCBs in fish, losses of PCBs during cooking and trimming can also be considered. For example, U.S. EPA (1993), Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory, applied a 50 percent reduction in PCB concentrations in advisory guidance for PCBs. The reduction was intended to account for cooking skin on fillet sport fish, with a 30% reduction factor recommended for skin off fillets, and this adjustment is not included in the determination of the 1.35 ppt screening value. Finally, the comparison of PCB TEQ values from small forage fish does not represent the population of large game fish that are taken for human consumption and are the subject of the screening value. If the eels were of sufficient size for human consumption, it is likely that the fillet results are approximately 1/3 of the reported whole body values. In addition approximately 50% of PCBs in the fillets would be lost during cooking. This results in estimated PCBs in the edible portion far below the 1.35 ppt values (Max value of 1.87 x 1/3 x ½ = 0.31 ppt). The two populations, small forage fish and game fish suitable for human consumption, differ with respect to foraging area and physiology, making any direct comparison of the forage fish results to the screening value invalid.

We have compared the fish tissue results to previous results for the Delaware River and the Great Lakes. All of the fish samples used in this comparison were whole body and were reported on a wet weight basis. Data was obtained from the DRBC 2000 fish samples (DRBC 2000), the 2001 and 2002 DRBC fish samples (Ashley et al. 2004), and the Great Lakes National Program Office [GLNPO] (USEPA 2003). The Ashley data was divided into two classes, large and small fish, with small fish denoted as (SF) in the following figures. Ashley did not report sufficient congener specific results to allow a calculation of TEQs. The data

associated with each data set are presenting using standard box plots (Tukey 1977). In the standard box plots the median (50th percentile) of each data set is shown with a black point. The blue box denotes the interquartile range (IQR) which is the 25th and 75th percentiles. The whiskers denote the most extreme samples less than 1.5 x the IQR outside of the blue box. Open blue circles denote sample results more extreme than the whiskers. Figure 1 presents two total PCB values on both a standard scale and a log base 10 scale. The green line denotes the NOEC, yellow line denotes the LOEC, and the grey line denotes the FDA action level of 2 ppm. Figure 2 presents the PCB TEQ values on both a standard and a log base 10 scale. The results show considerable overlap between the Metal Bank data and previous observations from the Delaware River and the Great Lakes. In fact the results from the Metal Bank site are among the lowest in this data compilation.

In conclusion, a close analysis of the results of the fish monitoring program demonstrates that the fish tissue concentrations are comfortably below the threshold value of 1 ppm. When the values are compared to fish tissue results from other investigations of the Delaware River and the Great Lakes, it is apparent that the values from the Metal Bank Site fish monitoring program are well below applicable background values and indicate that there is not a localized elevation of the PCB content of fish tissue in the vicinity of the site. Thus, the lines of evidence converge on the conclusion that the monitoring program results are well below the threshold value of 1 ppm and also well below applicable background. There is no evidence that site related PCBs in fish tissue represent an increase in risks to human health and the environment. Most significantly, the 2011 data are sufficient for USEPA's first five year review, and additional fish tissue sampling in 2012 is not warranted.

Bioaccumulation Monitoring

As required by the 2006 Utility Group Consent Decree, and described in the LTM (Arcadis 2011), a bioaccumulation monitoring event was conducted in 2011 according to the procedures in the Standard Operating Procedure (SOP – 05) which were reviewed and approved by USEPA. The bioaccumulation testing program is based on the in-situ exposure of *Lumbriculus varietgatus* to onsite sediments using cages. The methods are described in detail by Arcadis (2011) but are summarized here briefly. Biota sediment accumulation factors [BSAFs] are to be calculated using 4 in-situ caged worm deployments in the mudflat at the Metal Bank site and at two reference site locations for in-situ bioaccumulation testing. Sediment samples also are to be collected for chemical analysis at each of the bioaccumulation testing locations during each annual monitoring event.

The first round of bioaccumulation testing was completed in July of 2011. Of the six locations tested, no organisms were recovered from the two reference locations and less than 25 grams of the original 120 grams of mass were recovered for each of the four locations adjacent to the Metal Bank site (Bryan Lees, Normandeau Associates, Inc. personal communication July 2011). It is important to recognize that organism survival was not related to proximity to the Metal Bank site. Specifically, survivorship was lower in the references area than in the near-site areas.

The tissue samples collected at the end of the cage deployment were inappropriate for bioaccumulation testing and were not analyzed. The bioaccumulation monitoring program as currently implemented does not completely meet the goals of the LTM. It is our belief that the failure of the bioaccumulation monitoring is more related to the low quality habitat than the execution of the program.

We propose to replace the *Lumbriculus* monitoring program with a program based on the collection of [paired filed collected] *Corbicula* and sediment samples. The Group does not propose and respectfully declines the suggestion in EPA's January 24 letter that the Group implement a program in which bioaccumulation monitoring is conducted for both *Lumbriculus* and *Corbicula*.

We base our recommendations on two factors: (1) *Corbicula* are known to inhabit the mudflat while *Lumbriculus* was not identified in the recently conducted benthic community structure analysis, and (2) previous studies have demonstrated the comparability of the two test species in site specific analyses. The choice of organisms for bioaccumulation is critical to the success of the LTM program. For caged studies USEPA (2000) recommends the use of species that are well suited to the environmental conditions at the site and concludes that species that are naturally occurring, or surrogate species that closely resemble naturally occurring species, should be utilized (USEPA 2000). The Ecological Risk Assessment (ERA) (NOAA 1993) includes an assessment of benthic invertebrate community structure. Although not reported to occur in the study area in the ERA, *Lumbriculus variegates* are commonly used in bioaccumulation testing due to their many beneficial characteristics (e.g., pollution tolerance, of sufficient size to allow chemical testing, occupy diverse habitats, easy to culture in the laboratory, and do not require feeding) that make them an ideal test organism (USEPA 1994; USEPA 2000; Ingersol et al 1996). However, *Lumbriculus variegates* do possess some environmental sensitivities. This species inhabits the sediment leaving its posterior exposed to the overlying water for respiration, making this species potentially sensitive to exposure and desiccation. As documented in the LTM, the bioaccumulation testing locations are located well above the low tide line, resulting in twice daily exposure of the sediments to the air. The literature provides no evidence that *Lumbriculus variegates* is desiccation tolerant and in fact has been shown to form protective cysts under dry conditions. In addition, the recently conducted benthic community survey shows that *Corbicula* does inhabit the mudflat while no *Lumbriculus* individuals were identified. The field team is confident that sufficient *Corbicula* can be retrieved from the site to allow PCB analysis and the estimation of bioaccumulation. The field team also observed that the habitat at the site is inconsistent with the type of habitat known to be inhabited by *Lumbriculus* (Bryan Lees, Normandeau Associates, Inc. personal communication July 2011.) Based on the NOAA risk assessment, the high mortality in the 2011 bioaccumulation study, the benthic community survey, and the habitat characteristics, we conclude that the study area habitat is not suitable for *Lumbriculus variegates,* and therefore, an alternative species should be utilized. Indeed, *Corbicula fluminia* was identified in two benthic community structure assessment of the study area (NOAA 1993; ref for benthic community study).

Corbicula fluminia is well suited for bioaccumulation testing (Roche et al 2009) and is a common inhabitant of the study area (Bilger, Riva-Murray, and Wall 1999; NOAA 1993). In addition *Corbicula fluminia* has been used for bioaccumulation monitoring at a number of PCB contaminated sites (e.g., Lake Hartwell [GADNR,SCDNR,SCDOHEC,USACE and USFWS 2006]; Grasse River NY [Mcleod et al, 2008]; Anacostia Watershed MD [Phelps 2003]; and the Columbia and Willamette Rivers WA [Sherman et al 2009]). *Corbicula fluminia* is known to inhabit the study area and, based on its occurrence on intertidal mudflats, is likely to be resistant to exposure during low tide (Sherman et al 2009). *Corbicula fluminia* is a bivalve mollusk which is able to tightly seal its shell during low tide, preventing desiccation.

A review of the site history shows that bioaccumulation data has been developed for both *Lumbriculus* and *Corbicula*. These data were analyzed to demonstrate the comparability of both species for bioaccumulation monitoring specifically at the Metal Bank Site. We have located two

examples of previous bioaccumulation testing at the study site. The first utilized *Corbicula fluminia* (NOAA 1994) and the second utilized *Lumbriculus variegatus* (Diamond 2004). The *Corbicula* study was based on the measurement of field collected organisms and co-located sediment samples. The *Lumbriculus* study was based on caged worms exposed over 28 days and co-located sediment samples. Although *Lumbriculus* is generally believed to have increased exposure as compared to bivalves due to the ingestion of bulk sediment, both species are exposed to chemicals in pore water (Ingersoll 1996, EPA 2000). In addition, bivalves are known to consume material from the sediment bed either through deposit feeding behavior (e.g., Levinton 1991; Miller et al 1992) or feeding on particles, phytoplankton, and bacteria originating from the sediment bed and transported across the sediment bed (e.g., Levinton 1991; Bock and Miller 1995; Miller et al 1996). Specifically, there are numerous reports of juvenile and less frequently adult, unionoid and spheroid bivalves utilizing deposit feeding (Vaugh and HakenCamp 2001 and references therein). The literature also shows that *Corbicula* is capable of and routinely utilizes deposit feeding (Reid at al 1992; Hackenkamp and Palmer 1999; Vaugh and HakenCamp 2001). Thus, *Corbicula* is also subjected to dietary exposure to sediment borne contaminants in a manner similar to *Lumbriculus*. Diamond (2004) provides limited information on experimental design, and his datasheets and notebooks have been lost (Diamond personal communication). Thus, his results should be weighted less heavily than a validated study. Nonetheless, these two studies do allow a comparison of bioaccumulation associated with two different benthic species.

Although NOAA (1994) and Diamond (2004) provide differing levels of documentation and utilized different organisms and experimental design, the results do provide a mechanism to compare *Corbicula* and *Lumbriculus* bioaccumulation at the Metal Bank mudflat. Diamond compares his BAF for dioxin-like PCB congeners (4.13 -7.9) to those reported in NOAA (1994) (0.17-0.76), and he reports a difference as high as a factor of 50. Unfortunately, Diamond's comparisons are not valid. Specifically the BAFs reported by Diamond were reported in a dry weight tissue basis and the NOAA (1994) BAFs were reported on a wet weight tissue basis. Also, Diamond compared the highest congener specific values from his study to the lowest total PCB values from NOAA (1994) to arrive at the factor of 50 difference rather than comparing total PCBs and estimates of central tendency. We have recalculated the total PCB BAFs from both studies and have also calculated the lipid and organic carbon normalized BSAFs. As percent moisture values were not reported in NOAA (1994) we utilized a range of values consistent with those reported in the literature (85 to 90%). The *Lumbriculus* wet weight BAFs were calculated based on a typical literature value of 85% moisture. The recalculated BAFs and BASF are presented in Table 2. The results show a high degree of concordance between the two studies as well as the mean value of 4.5 from the Philadelphia Academy of Science for the Delaware River reported in Diamond (2004). In fact, the BAFs for *Corbicula* assuming 90% moisture are higher than those reported for *Lumbriculus*. The BSAFs (lipid and TOC normalized BAFs) for *Lumbriculus* are higher than those reported for *Corbicula*, but sample specific lipid values are not provided in Diamond (2004) and the source of the single lipid value used is not provided. This data gap prevents accurately calculating sample specific BSAFs considering that a single lipid value was used for all samples in Diamond's calculations. In addition, the consistency of the lipid values cannot be used to assess the condition of the *Lumbriculus* samples. Low lipid values could be indicative of stress as the organisms may exhaust their stored lipids under stress resulting in a high bias in the BSAFs. Based on these confounding factors, the *Lumbriculus* BSAF values should be seen as an order of magnitude estimate and are consistent with the *Corbicula* values. Based on these analyses, the available onsite data demonstrate that BAFs obtained using *Corbicula* are expected to be comparable to those obtained using *Lumbriculus*.

We have prepared an SOP to describe our proposed approach to *Corbicula* and have also revised our *Lumbriculus* SOP in response to your request. Both SOPs are attached for your review; however, we continue believe that *Corbicula* is the better suited for bioaccumulation testing for the Metal Bank site. If USEPA requires another attempt using *Lumbriculus*, we are concerned that usable data will not be generated.

Summary

Based on a detailed evaluation of the fish monitoring and the bioaccumulation monitoring conducted in 2011, we offer the following conclusions and proposed additional activities for 2012. In brief, we conclude that the 2011 fish monitoring did meet the goals of the LTM and additional monitoring in 2012 is not needed. We conclude that the bioaccumulation monitoring program was not successful in 2011 and propose changes to the program to ensure that usable data is collected in 2012. We have made clear our preference for *Corbicula* based bioaccumulation monitoring based on the available habitat and site specific data that shows the comparability of *Lumbriculus* and *Corbicula*. We recommend that Corbicula should be used in 2012 and in the subsequent round of testing in 2013.

If you have any questions regarding the subject of this letter, please feel free to give John Dobi or me a call.

Sincerely,

ENVIRON International Corporation

Joseph P. Vitale

Joseph P. Vitale, PE, L.S.P.
Project Director

Copies:
Cottman Avenue PRP Group
Dan J. Jordanger, Esquire
Jeffrey N. Martin, Esquire

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Table 1. Fish Monitoring Program Results

Sample ID	Location	Group Aroclor Wet Weight Basis Total (mg/kg)	EPA Aroclor Results Wet Weight Basis (original) Total (mg/kg)	EPA Aroclor Results Wet Weight Basis (2pk 1254) Total (mg/kg)	EPA Congener Results Wet Weight Basis Total (mg/kg)	EPA Congener Results Wet Weight Basis PCB TEQ (pg/g)
Forage Fish						
S1-TB-BK	Tacony Palymra Bridge	0.058	1.01	0.23	0.13	0.23
S1-TB-SM	Tacony Palymra Bridge	0.07	1.00	0.31	0.11	0.91
S1-TB-SMA	Tacony Palymra Bridge		0.78	0.26		
S1-TB-SS	Tacony Palymra Bridge	0.132				
S2-MB-MC	Metal Bank	0.082	0.57	0.22	0.24	4.33
S2-MB-SM	Metal Bank	0.136	1.27	0.34	0.09	0.61
S3-MB-BK	Metal Bank	0.05	1.47	0.45	0.10	0.16
S4-MB-BK	Metal Bank	0.05				
S5-PC-BK	Pennypack Creek	0.038	0.11	0.04	0.22	3.35
S5-PC-BKA	Pennypack Creek				0.15	2.19
S5-PC-MC	Pennypack Creek	0.014	0.28	0.11	0.12	2.35
S5-PC-SM	Pennypack Creek	0.129				
Eel						
S1-TB-ES	Tacony Palymra Bridge				0.11	0.75
S2-MB-ES	Metal Bank				0.18	1.20
S3-MB-ES	Metal Bank				0.22	1.87
S4-MB-EL	Metal Bank				0.49	1.48
S4-MB-ES	Metal Bank				0.22	1.69
S5-PC-ES	Pennypack Creek				0.07	0.31

Table 2. Bioaccumulation Monitoring at Metal Bank

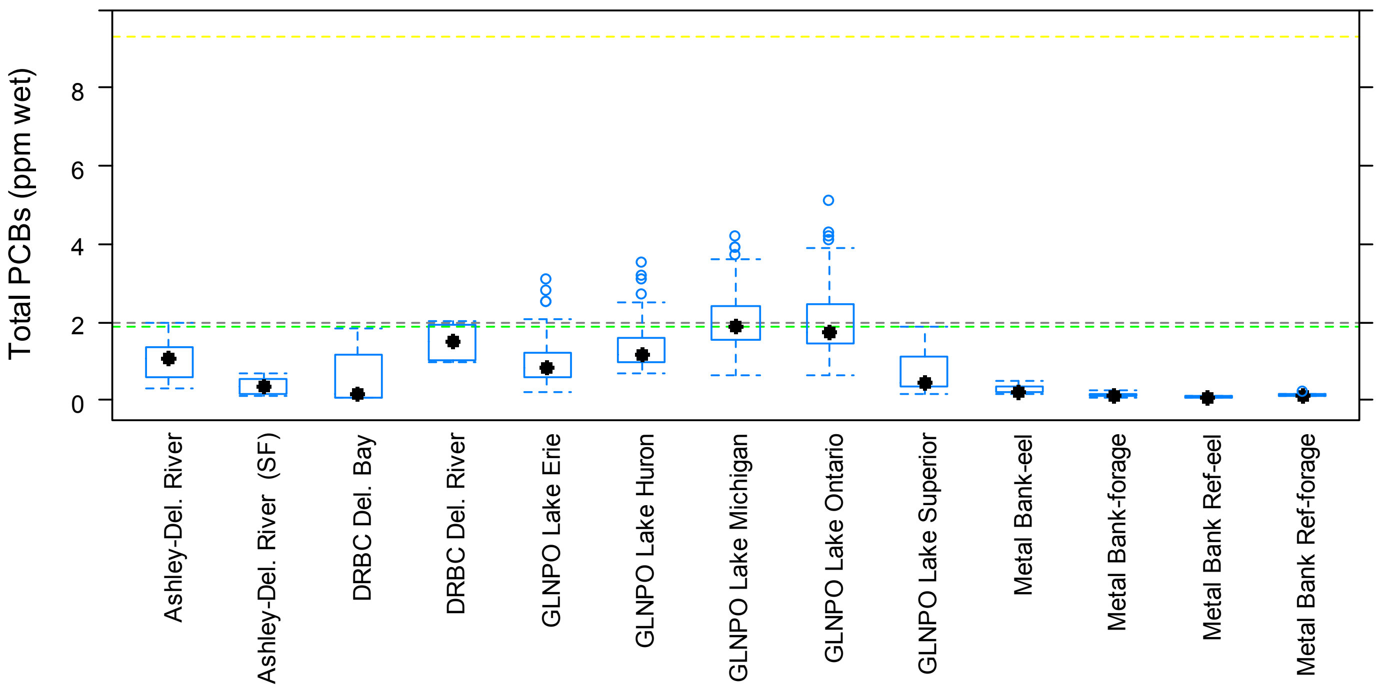
Lumbriculus (Diamond 2004 Expert Report)

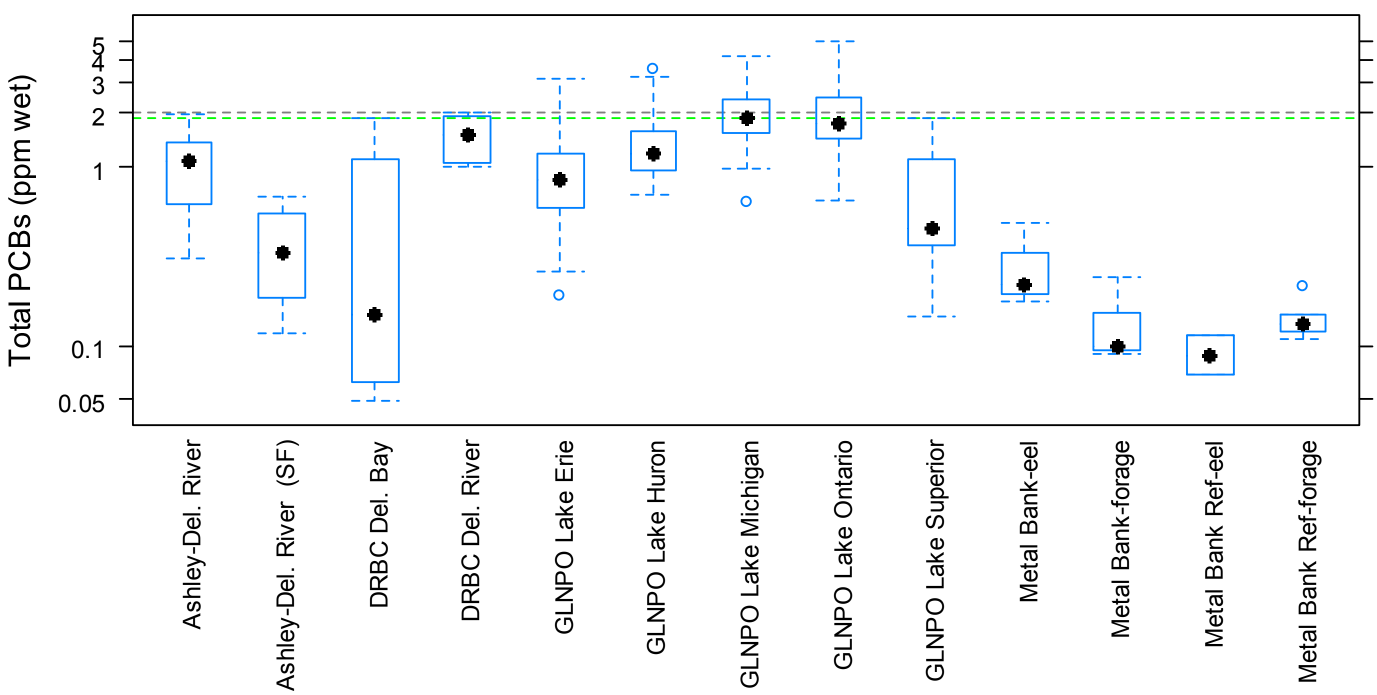
SID	MB-1	MB-2	MB-3	MB-4	Min	Max	Mean	Median
BSAF	11.63	7.70	2.53	8.03	2.53	11.63	5.95	7.87
BAF (dry)	4.72	3.21	5.74	4.02	3.21	5.74	2.54	4.37
BAF (wet assuming 85% moisture)	0.71	0.48	0.86	0.60	0.48	0.86	0.66	0.66

Corbicula (NOAA 1994 Eco Risk Assessment)

SID	MF-5	MF-7	MF-9	MF-10	Min	Max	Mean	Median
BSAF	0.52	0.97	4.13	1.43	0.52	4.13	2.55	1.20
BAF (dry assuming 85% moisture)	0.96	2.29	5.03	5.07	0.96	5.07	4.17	3.66
BAF (dry assuming 90% moisture)	1.44	3.43	7.54	7.61	1.44	7.61	2.75	5.49
BAF (wet)	0.14	0.34	0.75	0.76	0.14	0.76	0.50	0.55

BSAF = [mg tissue PCB / kg lipids]/[mg sed PCB/kg TOC]
BAF = [mg tissue PCB/ kg body weight] / [mg sed PCb / kg sed]
dry = the tissue mass does not include water
wet = the tissue mass does include water

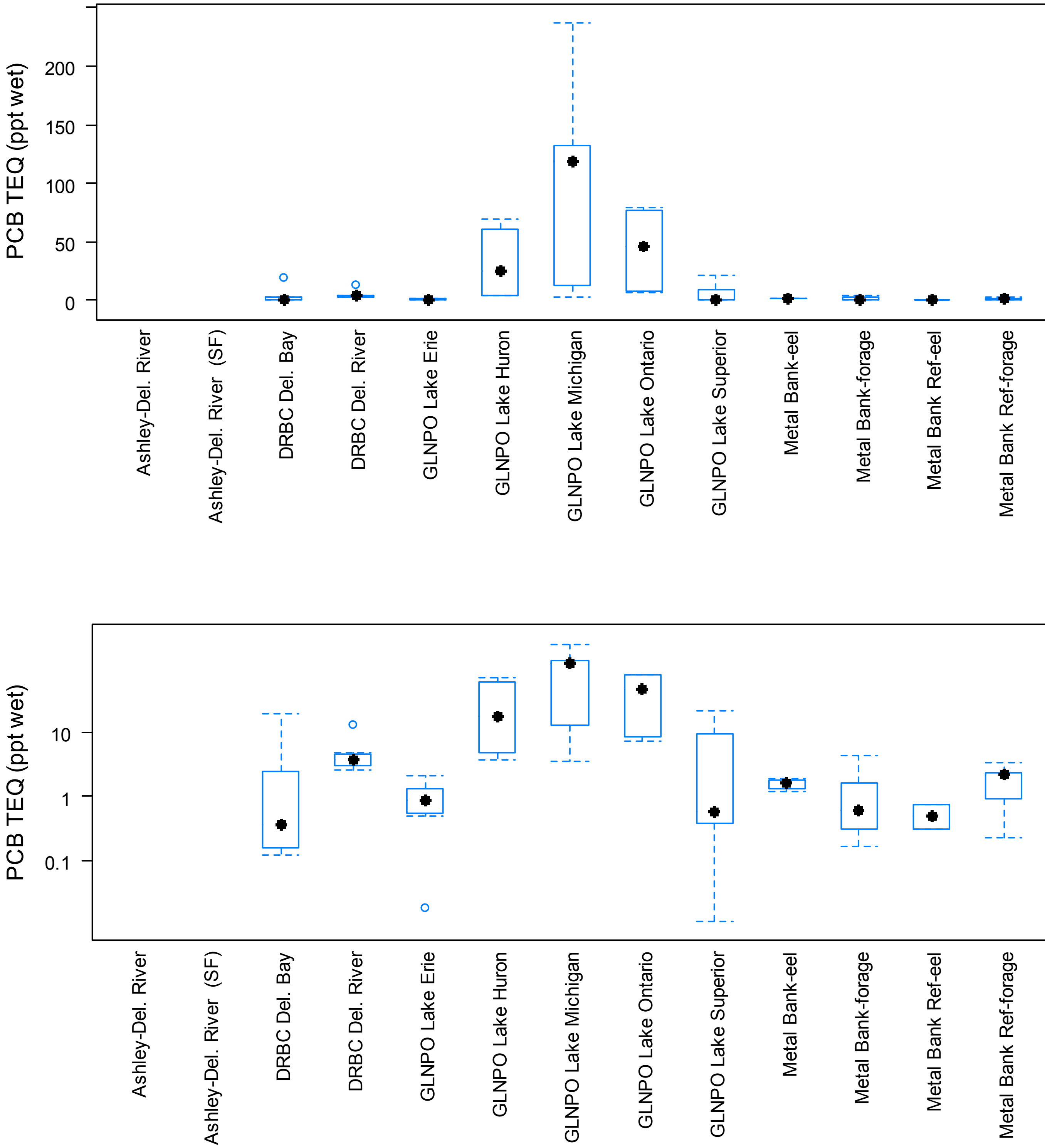




ENVIRON

Total PCBs

Figure 1



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Total PCB TEQs

Figure 2

Corbicula fluminea Bioaccumulation Sampling

I. Introduction

This procedure describes the equipment and methods to be used to collect *Corbicula fluminea* and sediments at the Metal Bank Superfund Site for bioaccumulation testing. The collections will be performed at four locations on the mudflat at the Metal Bank Site and at two off-site reference locations.

II. Equipment and Supplies

The following equipment will be needed to perform the *Corbicula flumea* sampling:

1. Measuring tapes, paper towels, field books, pens, pencils, digital camera, and Geographic Positioning System (GPS).
2. Six 5-gallon buckets
3. Clam rakes
4. Waders (chest or hip)
5. Gloves

III. Site Selection and Organism Collection

A. Sample Site Selection

1. Site reconnaissance will be performed to map the locations of clam beds at the Site and reference areas. Based on the Site reconnaissance, sample locations will be selected prior to the initiation of collection activities; four in the mudflat at the Metal Bank Site and two off-site.

B. Organism Collection

1. Thirty-five live *C. fluminea*, 3-5 centimeters (cm) in length, will be collected from each of the six locations using gloved hands and/or rakes. Organisms from each location will be placed in a location-specific 5-gallon bucket, which will contain local water. Collocated surface sediments will be collected from each location using the standard procedures previously used at this Site.
2. Living organisms will be rinsed of all debris and blotted dry with clean, dedicated paper towels. Collocated sediment samples will be shipped to the analytical laboratory for chemical analysis.
3. The live *C. fluminea* from each location will be placed in Site-specific beakers of clean culture water for a minimum of 12 hours to allow for gut purging.

4. After purging, a series of weights will be recorded for each organisms: total wet weight, wet weight of the shell, and wet weight of the tissue. Wet tissues from approximately 20, or more, organisms will be combined from each location until a composite sample of >20 grams of tissue (wet weight) is achieved (six composite samples, one for each location)

5. Each composite sample will then be labeled, placed in zip-lock bags, frozen, and sent to the lab as soon as possible for analysis**.**

IV. References

ASTM. 2001. Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates. E1688-00a. In Annual Book of ASTM Standards, Vol. 11.05, West Conshohocken, PA.

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In-situ Bioaccumulation Testing using *Lumbriculus variegatus*

I. Introduction

This procedure describes the equipment and methods to be used to perform *in-situ* bioaccumulation testing using *Lumbriculus variegatus* on a tidal mud flat for the Metal Bank Superfund Site long term monitoring activities. The testing will be performed at four locations in the mudflat proximate to the Metal Bank site and at two off-site reference locations. Six replicate test chambers will be installed at each sampling location.

II. Equipment and Supplies

The following equipment will be needed to perform the bioaccumulation testing:

1. Cellulose acetate butyrate (CAB) or similar material tubing (4-inch outer diameter and 12-inch-long section) and polyethylene end caps sized to fit tubing
2. 80-µm polypropylene mesh
3. Nalgene tubing (0.5-inch outer diameter[O.D.])
4. 100 milliliter glass tubes
5. 4-foot-long sections of rebar for marking test chamber locations
6. *Lumbriculus variegatus*
7. Hand tools including drill and ½-inch drill bit, pinch clamps, scissors, silicone caulk, elastic bands, wire tray shovel, 50- µm brass sieve, forceps, large glass dishes, a balance, and zip-lock bags
8. Personnel protective equipment (PPE) – including hard hat, steel toe boots, safety glasses, and clean disposable gloves (nitrile preferred)
9. Measuring tapes, field books, pens, pencils, digital camera, and Global Positioning System (GPS)
10. Tape – electrical, duct, and clear packing tape
11. Post-hole digger

III. Test Equipment Preparation and Test Procedures

A. Test Chamber Preparation

1. Cut the 4-inch O.D. tubing into 12-inch-long sections to serve as organism test chambers.
2. Drill approximately 30-40 holes into the sides of each tube and wrap 80-µm Polypropylene mesh securely around the entire chamber. Silicone caulk can be used to adhere the mesh to the chamber.

3. Install two polyethylene end caps on each test chamber.
4. Add one inlet port to the top side of each test chamber by drilling a 0.5-inch hole in the end cap and attaching an appropriate length of Nalgene (0.5-inch O.D.) tubing with silicone caulk. The inlet port should be closed with a plastic pinch clamp. Port tubing should be of sufficient length to extend above the water surface to allow for test organism addition after installation of the test chambers in the mudflat.
5. The assembled test chamber should be soaked in de-ionized water for 24 hours prior to use in bioaccumulation testing.

B. Test Organism Preparation

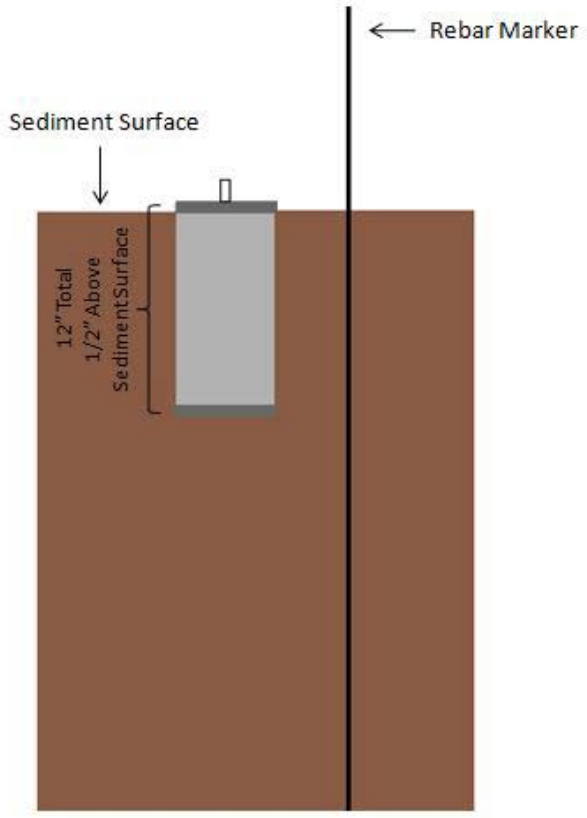
1. Lumbriculus variegatus are to be obtained from a reputable supplier.
2. Collect 10% of the test organism population and analyze for the compound(s) of interest prior to deployment of the test chambers.
3. Acclimate test organism population to Site water (including expected temperature) prior to testing.
4. For each test replicate, approximately 20 grams of L. variegatus are placed into a container with Site water. Organisms should be added to transport containers no more than two hours before deployment.
5. Six replicate test chambers will be randomly assigned to each of the six sites (four test treatment sites, two field control sites) and will be deployed over a 2-day period.

C. Test Chamber Deployment

1. Prior to initiating in-situ bioaccumulation tests, the testing and reference site locations will be determined and sediment for chemical analyses (total organic carbon) and grain size will be collected from each sampling location. Site water is to be characterized by measuring temperature, pH, dissolved oxygen, hardness, alkalinity, ammonia, conductivity, and turbidity.
2. Tests will include reference controls (culture water and control sediments), field controls (sediment has background level of compound of interest), and field test replicates.
3. Each field site (test and control) will consist of an identical number of replicate in-situ test chambers (six replicates).
4. Approximately one gallon of surficial sediment collected from each location will be placed inside each test chamber. Any obvious indigenous organisms will be removed from sediment before it is placed in the test chamber.

5. Once filled with sediment, pre-weighed *L. variegatus* (approximately 20 grams total) are added to each test chamber.
6. A post-hole digger (approximately 4-6” in diameter) will be used to dig a hole approximately 11.5” deep.
7. The test chamber will then be placed in the pre-dug hole vertically with ½ inch extending above the sediment surface. The hole will be carefully backfilled to make the test chamber snug in the sediment.
8. Water will then be added to the test chamber until approximately ¼-inch from the top of the test chamber.
9. A 4-foot length of rebar is to be driven into the mudflat at each testing location until only one foot remains above the surface, so test chambers can be located if they become buried. The final disposition of the test chambers in shown in Figure 1 (below).

Figure 1.



10. After three days to allow equilibration of water and sediment within the test chambers, a small amount of water is to be siphoned through the mesh screen and tested for dissolved oxygen concentrations. Site water is characterized by measuring temperature, pH, dissolved oxygen, conductivity, and turbidity.
11. Remove the pinch clamp from the inlet port and insert a small funnel into the port. The test organisms are to be added to each replicate chamber via the port. Gently flush the port with Site water to 'wash' test organisms into the test chamber.
12. Test chambers should be checked every Monday, Wednesday, and Friday during the exposure period (and as soon as possible after storms resulting in unusually high flow/turbulence on the river) to verify that the correct test chamber positioning is maintained.

D. Test Chamber Retrieval

1. After 28 days, the test chambers will be retrieved over a 2-day period.
2. Test chambers shall be located using the rebar markers and then gently extracted from the sediment up using a shovel.
3. Each test chamber should be checked for damage, e.g., holes in the window mesh that would allow test organisms to escape or indigenous organisms to enter.
4. A small amount of water is to be siphoned through the mesh screen and tested for dissolved oxygen concentrations. Site water is to be characterized by measuring temperature, pH, dissolved oxygen, hardness, alkalinity, ammonia, conductivity, and turbidity. Total organic carbon will be analyzed on chamber sediments present at the end of deployment.
5. Replicate test chambers will be placed in individual insulated coolers for each site and transported to a processing site. A completed chain-of-custody will accompany each cooler.
6. Upon receipt at the processing site, the chain-of-custodies will be reviewed and the contents of each cooler checked.
7. Organisms should be removed from test chambers and inventoried as either dead or alive within two hours after test chamber collection.

E. Test Organism Retrieval

1. The exterior of each test chamber will be rinsed with de-ionized water to remove any indigenous organisms adhering to the outside of the chamber.
2. Remove an end cap from each chamber, the contents of which are then emptied into a large, dedicated glass dish. The interior of each chamber will be thoroughly

rinsed with de-ionized water to ensure that all organisms are removed from the test chamber. Any observed indigenous organisms should be removed.

3. Test organisms in each test chamber are to be classified as either alive or dead. Death is determined by placing test organisms into fresh water. Healthy L. variegatus will be bright red and cluster into a tight ball. Dead and failing L. variegatus specimens will float separately and will have lost their bright red color.
4. An acceptable test should have at least 80% mean survival in control replicates.
5. Living organisms will be rinsed of all debris and blotted dry with clean, dedicated paper towels.
6. The live L. variegatus will be sorted from each replicate and composited for the location as a whole, then placed in beakers of clean culture water for a minimum of 12 hours for gut purging.
7. After purging, test organisms at each location will be blotted dry, weighed, placed in zip-lock bags, frozen, and sent to the lab as soon as possible for analysis.

IV. References

ASTM. 2001. Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates. E1688-00a. In Annual Book of ASTM Standards, Vol. 11.05, West Conshohocken, PA.

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